# Notebook, N-88-05-31

This notebook covers the period May-December 1888. There is also one entry from February 1889. At the beginning of the book are several pages of instructions from Charles Batchelor to Robert T. Lozier regarding experiments on a multipolar dynamo. Most of these experiments appear to be concerned with "Fo[u]cault currents" (eddy currents). The remainder of the book contains the results of experiments probably conducted by Lozier, along with scattered entries by Arthur E. Kennelly. There is also a 3-page list of contributors and contributions for a birthday "testimonial" to Edison. The front cover is labeled "Mr. Lozier No 503" and "Multipolar Dynamo May-Dec. 1888." The inside front cover is inscribed "Mr. Lozier Book 503 May 31st 1888." According to a list of laboratory experiments, ca. 1903, this book was also assigned the number "69." The pages are unnumbered, and several pages have been removed from the book. The book was used in both directions. Approximately 60 pages have been used.

YE-172    N-88-05-31

Mr Lgier

Book 503

May 31st 1888

14/100

May 31 1888

Multipolar Dynamo

Run at 820. Rev.

#1 Put all Magnets in multiple arc – making ~~[illegible]~~ in multiple or about ~~[illegible]~~ ohms of ~~about~~

~~Make &~~ charge its ~~own~~ field & run 100 Volts 15 minutes without load ~~except its own field~~

Take increase of temperature on iron core & see if it is sensibly hotter at the edge than the middle, by using two thermometers

Take speed – & Volts + amp or & time charging curr

Be sure that each alternate pole is P + N

Take amperes in field &

~~Be sure to use resistance for external that will carry at least 20 amperes~~

Multipolar Dynamo    May 31 1888

#2 Exp. With Magnets in Series
(12 Double spools in M. a.) as
they are now —
Run 15 minutes with 6 amperes
in Magnet circuit —
No load on machine
Take temperature of iron
(middle & ends)
Full speed 820 Rev.

Multipolar Dynamo May 31 1888.

#3 Magnets 24 in M.A.
Put on load of 400 Amp.
and if volts not too low
get on up to 600
Run only a short time &
take heat note whether
leading wires hot as
well as armature wire.

Lozier

Connect all magnet spools in
multiple arc & charge with
100 volts from the #20 —
Put on 440 amperes on armature
& take volts at brushes.

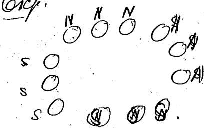
CB

#5

June 24 1888

Multipolar Dyna -- May 31st 1888.

#4 Exp.



Charge these with same volts & have same current passing as in #1

Run full speed and take increase temperature of iron after 15 minutes

Foucault Currents

#1 June 14/88

Tested Started at 8.40

Fields 2 coils in series
12 multiple-alternate poles

Ran for 15 minutes

Temp of room at starting 80°

100 volts at field terminals

10.4 amperes in field

No current on Armature circuit

Temp of Armature in middle

Temp at sides

Speed 820

found faulty thermometer & ran for ten minutes more after shutting down for 15 minutes —

Started at 9.10

Stopped at 9.20

Temp of Field middle 198°

" " " Side 230°

Volts 97

Amperes 10

Speed

Foucault currents

#4 June 1/88

2 coils in Series 12 in Arma.

~~Top of~~ pit cores on top north pole

(Fields " separately " excited bottom " south "

armt circuit open

Speed ---- 800 — 800 at end 816

Amp in field --- 11.5

Volts at terminals -- 101

~~Time started~~ -- 11.25

Time ended --- 11.40

Length of run --

Temperature of armt middle — 131°

" " " side 129°

Temp of " at start 105° F (Approx)

" " Room 74° F

Stopped for 10 minutes & resumed at 11.55 ran

for 10 minutes

Volts 100

Amps 11

Speed 800 — 817

~~June 1st~~

~~24 coils in Multiple Arc —~~
~~Alternate Poles~~
~~Test started at~~
~~" Ended at~~
~~Duration~~
~~Speed~~
~~Volts~~
~~Ampere in field~~

Foucault Currents

June 2/88.

24 coils in multiple ~~series~~ alternat
poles

Test Started at 2,10
" Ended at 2,25.
Amperes in field 5,5
Speed 8,14

Temperature of Armat in middle 93
" " " at ends 103
" " Room 72°7
Test shut down for 15 minut
Started at 2,40 ran for
10 minutes under above condition

#5 Multipolar — June 2 1888

Take indicator cards as follows:—

1st Engine running with #20 running & countershaft running but no belt on Multipolar & no load any where except 11½ ampere on #20 (Charging its own field)

---

2" Same with Multipolar running empty

---

3 Same but with the 11½ amp on #20 running through field of Multipolar all in M. A.

Foucault's currents

#2 June 4/88

Coils 2 in series 12 M. a alternate
discs

Test Started at 11.25

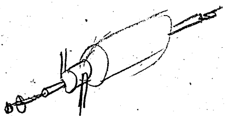
Amperes in field 5.5 after 5 minutes
changed to 5 1/4 amps.
Speed 820 revolution

Shut down for 15 minutes
then ran for 10
T. Speed 818
Temperature of Armt middle 146
" " " end 157

Room

---

June 4 1888



— Magnets in place but not charged —

— Hang the armature in centres so there is no friction

— put brushes on lightly

Pass 25 or 30 amperes through the brushes & armature & see if it turns around or takes any direction

Move brushes a little either way to see if it will do it better —

June 5/88

[illegible] Started at 8.20

Amperes through field

Volts at field terminals

" " at Armt "

Amperes Load on armature

Speed

First stopped

Speed. 810

Amperes through field 41.5

Volts " " 100

" on Armature 112

---

Multipolar Dynamo 1888 June 4

#6

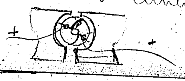
See how little current you can pass through the magnets to get 112 Volts out of the Armature

June 5/88

Took a #2 Dynamo with current flowing between two centers passed a current of 250 amperes through armature, the field being entirely disconnected; at beginning of test set brushes at angle of 45° (~~[illegible]~~ 14 bars each) from neutral point but got no effect.

— Moved brushes slightly forward ~~until~~ for 2 bars which was found to be the point of maximum effect — It revolved at this point at about 800 revolutions — current at start 24.5.

At final speed 21.5



Multipolar Dynamo. June 4 1888.

#7. Take a saturation curve of Multipolar as follows:—

Disconnect all magnets but one pair & set brushes for that one pair

#40

June 8"/88

Experiment to determine Foucault currents in Multipolar Dynamo

Took #1 machine with pole pieces cut out & stripped a #1 Armature - put on three layers of tape

Test started at 2.10 P.M.

Speed

" at end 1680 - 1690 = 1685
1620 1610

Amperes through field 2.55

" " at end 2.55

Increase of 10° in temp

June 9/88

Tried above exp on #1 dyn (used as motor in [illegible] Dept)

Test Started 9.40
ended 12.00
2 hrs 20 m

Speed 1755

Amp through field Started with 4.25 ended with 3.5

Temp of room 78° F

" " Armt (max) 120° F

Full Load

June 11/88

Multipolar Dynamo

Test started at

amperes through field

volts at brushes

~~Speed~~

Amperes on dynamo

Speed

| volts | Amp | volts | |
|---|---|---|---|
| 60 | 180 | 90 | 160 |
| | 360 | | 400 |

440
200 ~~390~~
640 = 80 volts
amp

60 amps thru field

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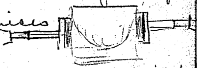
Foucault Currents

June 11/88

Took a #1 Arm. Shaft, turned on bobbin of wood projecting beyond field pieces



in which was wound red oxidized (rusted) iron wire.

Test started at 8.40

Speed 1680

Amperes through field 4.1

Temperature from room 78°

" " Arm 115°

Dimensions of Dynamo Room

Side "A" = "Facing South West.

Side B -

Side C =

[illegible]

Rod running from tube underneath sills - slings on

middle 49.[illegible]" + 15¼" + 4½"

upper 42.7" + 20½" + 7⅛"

lower 40.7" + 11" + 5¾" 7⅞

$17\frac{5}{16}$ 64.9 70.9

62 48

$12\frac{5}{16}$ 47 31

48 33

$7\frac{1}{8}$ 221 57

180 57

296

8¾

3⅝

22

19

41

Upper Middle Lower

Tube

| Upper | | Middle | | Lower | |
|---|---|---|---|---|---|
| 42. | 7 | 49. | | 40 | 7 |
| 1 | 8½ | 1 | 3½ | | 11 |
| | 7⅛ | | 4½ | | 5¾ |
| | | ~~8~~ | ~~8½~~ | 1 | 3 | 3 |
| 12 | 5 | 12 | 10 | | |
| 7 | 3 | 7 | 3 | 7 | 3 |
| 6[illegible] | 9 | 70 | 9½ | 62 | ~~30~~ ½ |

| Upper | | Middle | | Lower | |
|---|---|---|---|---|---|
| | | ~~[illegible]~~ | | 26 | 3 |
| 2 | 11 | 25 | 7 | 14 | 6 |
| 1 | 6 | | | 8 | |
| 8 | | 1 | 4 | ~~[illegible]~~ | ~~19~~ |
| 47 | ½ | 48 | | 48 | 9 |

| | | | | | |
|---|---|---|---|---|---|
| ~~11~~ 10 | | 19 | 3 | 13 | 2 |
| 15 | 2 | 8 | 6 | 5 | 11 |
| 7 | 4 | | | | |
| 22 | 6 | 27 | 8 | 19 | 6 |
| | | 49 | | | |

Rods running from tube

[illegible] from Dynamo

#10

Dynamo Leads

20 — 24.9 26.5

7 20 7

32 31 9 33 5

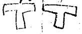
65 ft

37 6 37.6

13 11 13 11

5 7 5 9

5/8 1/2



~~4~~ ~~4~~

57 57 2

5/8 1/2

5/8 Connectors

2 6

~~2~~ 1

4 2

2 1

2 1

~~8~~ ~~4~~

10 13

3 63

154

—

64.9 - 9 | .41

70 - 9

62 - 6

47 - 6 64

48 - 1 178

48 - 9

31 - 9

33 - 5

57 - 2

57 - 2

517 - 58

5

522

63

45 ~~7~~

21.1 - 23.9

20 - 6

41.7 23.9

26

26

30

78

150

21.1

23.9

20.6

| 5/8 | 1/2 |
|---|---|
| 64.9 | 70.9 |
| 62 - 6 | 48 - 1 |
| 47 - 6 | 31 - 9 |
| 48 - 9 | 33 - 5 |
|  | 57 - 2 |
|  | 57 - 2 |
| 22 1-30 | 29 6 28 |
| ~~224~~ | 298 |
| 298<br>522 | 298<br>27.9<br>271 |
| 226<br>41.7<br>182<br>182 | 271 |

200
~~300~~ " 5/8" Copper rod
2~~6~~0 " 1/2" " "
~~120~~ " Porcelain ins knobs 2×1 11/16
10 Connectors for 5/8" rod
13 " " " 1/2" "
4 " " 5/8 "
4 " " " 1/2 "
4 " " 5/8 "
6 " " " 1/2 "

150
201
211
3 160 150
271

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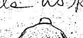
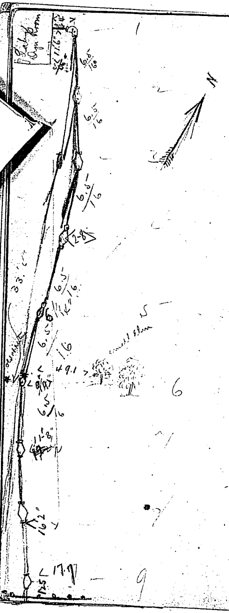
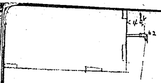
(4½")

✓ 265 feet 5/8" Copper rod
✓ 200 " 1/2"
✓ ~~200~~ 225 Porcelain Insulated Knobs 2" × 1 11/16
1 05 " " " 1½" × 1¾"
✓ 30 Connectors (copper) for 5/8" rod
✓ 20 " " " 1/2" rod
✓ 4 " " " 5/8" rod
✓ 4 " " " 1/2" "
✓ 6 " " " 5/8" "
✓ 4 " " " 1/2" "
4 feet 7/16" hard rubber tubing
1/4" hole
16' 6" – 1" polished fine gilt brass tubing cut in 4' 1½" lengths
6 ceiling flanges
~~8~~ 3 Open brass chandelier
sliding canopies to fit 1" tube
2 end bells as per our letter Aug 7/86


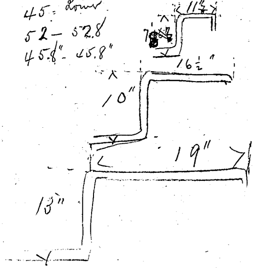

N
11.6
6.5/16
6.5/16
6.5/16
2-8
33.6
6.5/16
6.5/16
small elm
49.1
6.5/16
11-8
16'2"
17.7
12.5
1
6
9



#1= 3/4" Copper +

| # of tube | Dia of + copper | Depth |
|---|---|---|
| #1 | 3/8" | 2' 3" |
| 2 | | 2' 8" |
| 3 | | 2' 5" |
| 4 | | 1' 7" |
| 5 | | 2' 5" |
| 6 | | 2' 5" |
| 7. | | 2' |
| 8 | | 1' 7" |
| 9. | | 2' |

45 = Lower
52 – 52.8
45.8" – 45.8"


11¾"
7¾
16½"
10"
19"
13"
Lower

12. 6. 88

22·10 Commenced running
armature made with simple iron core covered with ins: tape & canvas. about 4000 revs. per min $= 66 \times 1\frac{1}{3}$
$= 88$ feet per sec. circum speed
Field charged by 110 volts

22·20 Stopped running

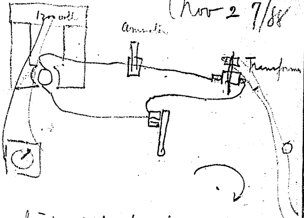
·23 Temp taken 86° + 90° F
bush side / pulley side
bulbs in cotton waste pressed against sides

22·32 Commenced running
wooden core & iron single wire armature covered in tape & canvas
Conditions same

·46 Stopped running

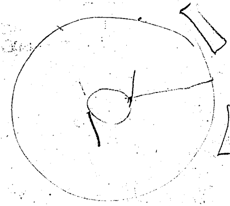
·52 Temp taken in centre on canvas Temp 90
Core slightly hotter than first or previous

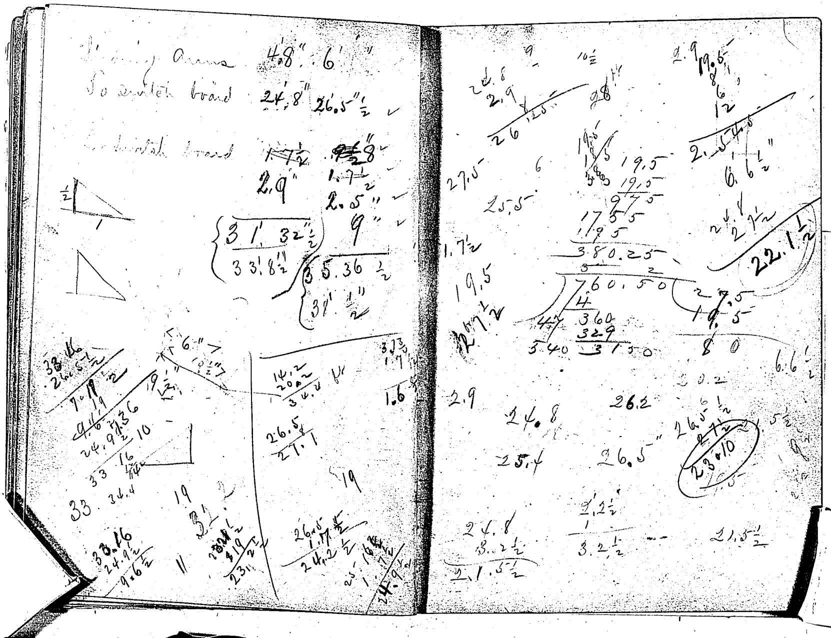
Nov 27/88


120 volts
Ammeter
Transformer

Ran test with brushes opposite
on lower commutator & no brushes
on upper comm. for half an hour
at (fully) 1000 volts pressure
Should not exceed 2 amperes.

above Test started 13.43
volts 1370
amp 1.9 } at 13.58 load set
~~Start~~ volts 1370
amp 1.9
Shut down at
14.13 on a/c
hot bearing





[illegible] area 4'8" 6'

So switch board 24'8" 26'5"½

[illegible] switch board ~~1'7½~~ ~~9½~~8"

2'9" 1'7½

2'5"

9"

31' 32"½

33'8½"

35.36 ½

31' ½"

<6">

9½"

19½"

38.16

26.5½

19

9.6

24.9½

33

33.16

24.9½

9.6½

14.2

20.2

34.4

26.5

27.1

26.5

1.7½

24.2½

1.6

19

26.8

2.9

26.2.5

28"

27.5

25.5

1.7½

19.5

19.5

19.5

975

175

19.5

380.25

760.50

4

360

329

31.50

540

2.9

19.5

8

6

12

2.5.4.5

6.6½"

2'7½

22.1½

27.5

19.5

8.0

6.6½

2.9

24.8

26.2

25.4

26.5"

26.5

6½

2.7½

23.10

24.8

3.2½

21.5½

3.2½

3.2½

21.5½

24'8"

26.5 1/2

24.8
3.1 1/2
21' 6 1/2

26.5 1/2
3.1 1/2
23 10

2.10"

24.6
1.7
25.10

24.8

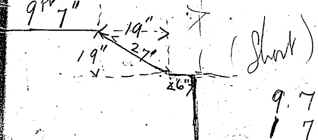
26.5 1/2
1.6
24 11

24.10

9.7
1.6
24.15
25.3

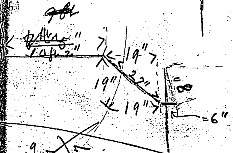
10.4

Bend one rod 9ft 7 ~~[illegible]~~ in from end at angle of 40° thus – ~~the~~


9ft 7"
19"
19"
27"
6"

(Short)

9.7
1 7


~~9ft~~
~~9ft [illegible]"~~
10ft 2"
19"
19"
27"
19"
8
=6"

9'1/7

Multipolar Dynamo Dec 3/88

~~Field 42 amp~~
~~Volts 165 amp~~

---

10.57 am

160 volts

42 ampers on Field

95 " " ampmeter (Load

25 deflects 2 [illegible]
2 wires

11 — am.

155 volts

40.5 amp on Field

48 deflect

220 on amp meter (Load)

4 Wires

40.5
4.9
30
155

---

11.03 4 3/34

149 volts

37. amp on Field

270 amp on Load

69 Deflec

6 Wires

---

11.05 —

143 Volts

36 Ampers

370 amp on Load

80 Deflec

8 Wires

---

139 volts

34 amp on Field

57 425 amp on Load

92 Deflec

10 wires

135 volts

34.5 amp

102 Deflec

12 wires

131 volts (   )
127 volts (ayrton & P)
32 amp on field
amp meter off scale
109 Deflec
14 wires

129
123.5 volts (A & P)
11-12 30.2 amp on field
115 Deflec
16 wires

Shut down at 11.14
Temp 132°F 11.20
" 135° 11.42

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Started 12..
volts 160 A & P
39 amp in field
X 155 amp on ammeter
22 Deflec
2 wires

12.02
149 volts
37 amp on field
X 150 ammeter
48 Deflec
6 wires

---

1203 138 volts
36.5 amp on field
86 Deflec
X 230 ammeter
10 wires

---

1204 136.5 volts
32.2 amp on field
110 Deflec
280 ammeter
14 wires

Time 1206
Volts 115
Amp on Field 28.7
Deflec 130
X Ammeter 330
Wires 18

Time
Volts 107.
amp on Field 26.2
Deflec 178
A 375
Wires 22

Time 13
Volts 105
Amp on Field 25
Deflec 120
Ammeter 372
Wires
Temp
Shut down at 1 P.M. Hot bearing
13-10 = 204.5°F 13-23=203°F
13-20 = 205°F

~~15-30~~
16.0.

9' – 8"

inside 11—9½ 12-2 outside

26.8½
11.9½
14.8 11½

28.10
11.9½
12.10½

25.17½
12.

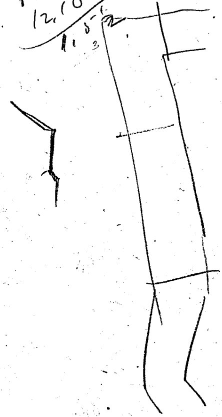
26.5½
12
14.3½

Outside one to wall 26.5½
Cut off rod 14' 3½"

Inside one to wall 24.8.
Cut off rod 12-1.0½

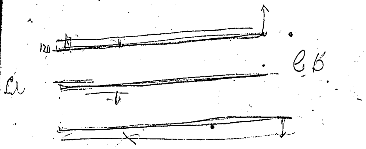
17½

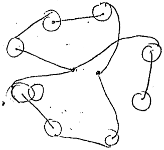
13.75-½
12.10
1.5-½

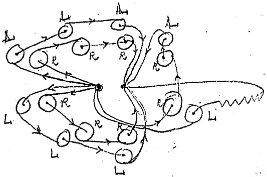


| Time | Volts | Amp | Wires | Ammeter | Def. |
|---|---|---|---|---|---|
| 15.30 | 160 | 41 | 2 | 95 | 28 |
| .35 | 150 | 37 | 6 | 280 | 50 |
| .40 | 138 | 33 | 10 | 440<br>430 | 78 |
|  |  |  |  | 230 |  |
| .42 | 120 | 28 | 18 | 300 | 115 with def |
| .45 | 114 | 27 | 20 | 360 | 114 |
| .50 | 109 | 25 | 22 | 370 | 125 |
| .55 | 102 | 24 | 26 | 380 | 109 |
|  |  |  |  | 385 |  |
| 16.00 | Speed 8920 |  |  |  |  |
| .12 | 101 | 25 | 19 | 340 | 95 |
| 16.40 | 98 | 23.5 | 19 | 333① | 83 |
| Speed 830 (100 amp) |  |  |  |  |  |
| 17.00 | 99 | 21 | 19 | 335① | 85 |

10 Shut down
35 Temp 218°7
48 " 225
 " 228
55 " 221



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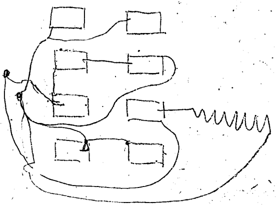

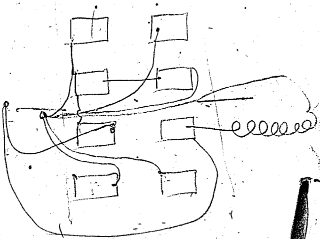

19.40 Commenced running

000
000
000
000
000
0

62 amperes in field cct.
375 indicated : log. Def
20 wires
130 volts

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20.10
55 amperes in field
370 indicated
20 wires
123 volts
21.10 Shut down to file brushes
21.18 193°
.35 221.

22:30 Started again
53 Amps. in field
360 Indicated
20 wires
115 volts.
23:30
48 Amps. in field
350 indicated
20 wires
110 volts.
24:30
47 Amps. in field
345 indicated
20 wires
110 volts Rev. 725
1:00
44 Amps. in field
325 indicated
20 wires
volts 102 Rev. 720

{ Steam low

2:00
Amp. in field 45
indicated 325
20 wires
volts 103 Rev. 705

steam still low 70 lb

2:30 Rev. 750

3:00
Amp. in field 45
Indicated 325
20 wires
volts 104 Rev. 730
Brushes gave out + shut down for repairs
Temp of Arm. 250°

---

Started up 4:30
Amp. in field 57
Indicated 375
volts 120
20 wires Rev. 790

5:30
Amp. in field 49
Indicated 360
20 wires
volts 113

6:00
Amp. in field 48
Indicated 360
Volts 112
20 wires
Rev. 700

6:30
Amp. in field 47
Indicated 350
Volts 112
20 wires

7:00 readings same
Shut down again to repair Brushes
Temp. of Armature 260
~~Start up again by 8 o'clock if~~

2-5-3/16

65-0

2 3/4"

4"

2 5/8"

2ft

2 5/8

4"

1 5"

2 5 3/16

2 12/16

4

# 15/16

1. 5 1/2

1. 6 1/2

2.11.89

75.57 29.750

65°

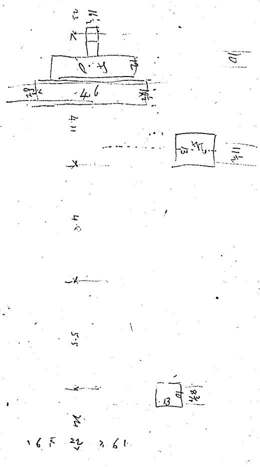
50

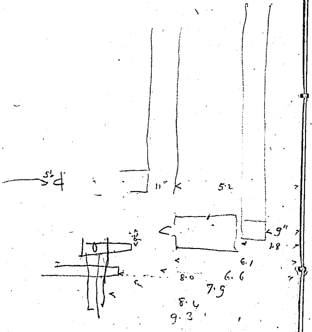
64

57

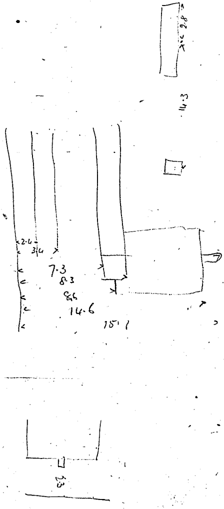
58

0.92

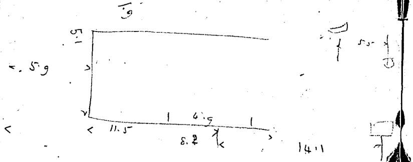




5½
11"
5.2
8
9"
1.8
6.1
8.0
6.6
7.9
8.4
9.3



2.8
14.3
2.4
3.4
7.3
8.3
8.6
14.6
15.1
3.3


1.9
5.1
5.9
4.9
11.5
8.2
14.1
5.5

| Name | Amt | In B | When comp'y |
|---|---|---|---|

| Name | Amt | In B | When comp'y |
|---|---|---|---|

| Name | Amt | ~~[illegible]~~ | Time employ't |
|---|---|---|---|
| [illegible]kan | $1.00 | yes | Dec 15"/88 |
| W R L Dickson | 1.00 | + | " 15/88 |
| Rube Hepworth | 1.00 | + | " 15/88" |
| Geo Gilmore | 1.00 | + | " 15 |
| Jim Duncan | 1.00 | + | " 15 |
| Sam Jenkin | 50 | + | " 15 |
| Thos Wharton | 50 | | " 15 |
| Alfred Ludecke | 1.00 | + | |
| W Westring | 50 | + | " 15 |
| Titus | 1.00 | + | " 15 |
| ~~Henry Obame~~ | | + | |
| Henry Rieve | | | |
| Thieme | 50 | + | " 15 |
| R Fessenden | 1.00 | + | " 15 |
| Wolkee | 1.00 | + | " 15 |
| J Gonyard | 1.00 | + | " 15 |
| John Lord | 1.00 | + | " 15 |

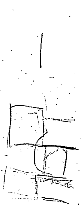
| Name | Amt | Mr B | Time empl |
|---|---|---|---|

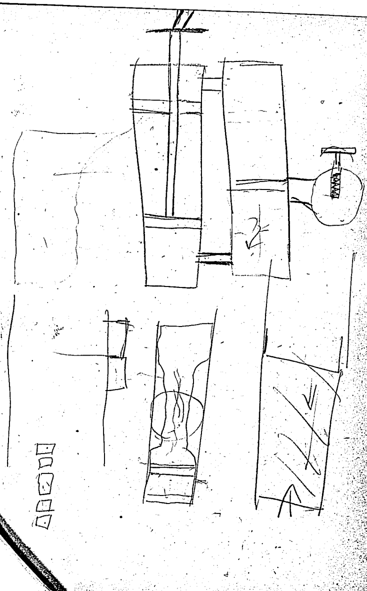
# Testimonial

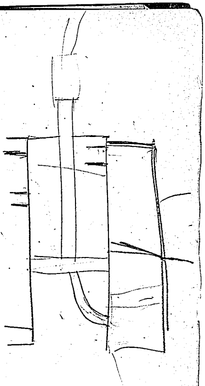
| Name | Amt |  | When can pay |
|---|---|---|---|
| Mr. Binning | $1^{00}$ | + |  |
| " McGinnis | $1^{00}$ | + |  |
| " Elliott | $1^{00}$ | + | Dec 15 |
| " English | $1^{00}$ | + | Dec 15 |
| " Fince | $1^{00}$ | + | " 15 |
| " Ott | $1^{00}$ | + | " 15 |
| D H Deems | $1^{00}$ | + | " 15 |
| Geo Hofmeyer | $1^{00}$ | + | " 15 |
| A E Kunnelle | $1^{00}$ | + | " 15 |
| Henry Faulkes | 50 | + | " 15 |
| Geo Bowie | $1^{00}$ | + | " 15 |
| Del Fowler | $1^{00}$ | + | " 15 |
| Joe Bolotinkie | $1^{00}$ | + | " 15 |
| Jas Dobbins | $1^{00}$ | + | " 15 |
| Mr Mullen | $1^{00}$ | + | " 15 |
| John Wilde | $1^{00}$ | + | " 15 |
| J. T. Marshall | $1^{00}$ | + | " 15 |
| J W Gladstone | $1^{00}$ | + | " 13 |

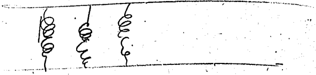
| Name | Amt. |  | When can pay |
|---|---|---|---|
| J Lehmann | $1^{00}$ | + | Dec 15 |
| A. F. Brigham | $1^{00}$ | + | " 15 |
| Ed Ronlinger | 50 | + | " 15 |
| Prof Gilmowsky | $1^{00}$ | + | " 15 |
| Jno Dorr | 25 | + | " 15 |
| Geo Sloane | 50 | + | " 22 |
| S Allen | $1^{00}$ | + | + 15 |
| J Hayes | 50 | + | " 15 |
| H Meiller | $1^{00}$ | + | " 15 |
| H Kayser | $1^{00}$ | + | " 15 |
| Mr Dahl | $1^{00}$ | + | " 15 |
| Harburger | 50 |  | " 15 |
| Devonaldo | 50 | + | " 15 |
| Mr Kuntz | $1^{00}$ | + | " 15 |
| R Hoyt |  | + | " 15 |
| F Wellington | $1^{00}$ | + | " 15 |
| Thompson | $1^{00}$ | + | " 15 |
| Geo Allen ② | 50 | + | " 15 |

Bund

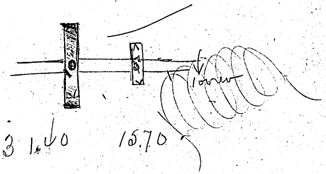




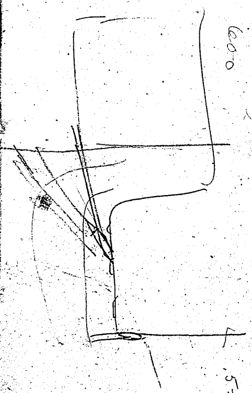




$$\frac{5}{24}$$



3 1.40 15.70



$$E = \frac{.5}{1200}$$

600

$$1200\overline{)5000}$$

$$\frac{\begin{array}{r}200\\6\end{array}}{1200}$$

$$C = \frac{E}{R}$$

$$.5 = \frac{E}{1200}$$